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THE FAD AS A FACTOR IN BOTANICAL PUBLICATION[1]

By Dr. NEIL E. STEVENS

BUREAU OF PLANT INDUSTRY

IF, as Pope and many others have asserted, "the proper study of mankind is man," botanists may occasionally study botanists and no apology is needed for asking this botanical society to direct its attention to one of the manifestations of botanical psychology. It is obvious that all we know about plants comes to us through the medium of the botanical mind, and in studying the botanical publications of any period, it is important to know what botanists were thinking about at that time. For, much as we may dislike the idea, we must admit that the conclusions which investigators draw from their observations, perhaps even the observations themselves, or at least the kind of observations they are most likely to make and to publish, are influenced by what others are observing, publishing and talking about.

In the work of the Plant Disease Survey we deal constantly with observations made by others, and in an attempt to study the relative incidence of disease at different periods it becomes of first importance to discover what particular diseases were in fashion and thus most likely to be noticed at any given time. It was, then, this practical necessity which led me to spend a good deal of time during the past year in reviewing American botanical literature. Some of the incidental results of this study I wish to discuss tonight. To avoid wearying you beyond endurance I have confined the statistical portion of this paper to the last 50 years, 1881 to 1930, and to the following representative American publications: *Bulletin of the*

[1] Address of the retiring president of the Botanical Society of Washington, D. C.

Torrey Botanical Club, Botanical Gazette, Phytopathology, American Journal of Botany and the botanical material contained in the scientific publications of the U. S. Department of Agriculture, including the *Journal of Agricultural Research* and the *Contributions of the U. S. National Herbarium* in so far as these represent the work of the members of the Department of Agriculture.

I am aware of course of the immense volume of American botanical matter outside of this list and of the still greater volume outside of the United States, but the material chosen is merely illustrative, and I must bear in mind the necessity of having enough people left at the conclusion of this paper to elect officers.

The curve[2] which gives the total pages of botanical matter exclusive of reviews and abstracts in these publications indicates an increase so great as to eliminate any question of observational error. From a paltry 259 pages in 1881, we attained in 1929 an all-time American high of 5,284. To be sure, the botanical output, like the stock market, broke sharply in 1930, and the curve of increase seems to lose some of the steepness after 1918 or 1919. Nevertheless, this output, especially when viewed against a background of other special journals, experiment station publications and foreign literature in many languages, presents an aspect which is little less than appalling.

Of what does this mass of botanical print consist?

Its composition varies from year to year as a little study or even reflection will speedily reveal.

SPACE DEVOTED TO VARIOUS LINES OF BOTANY IN THE AMERICAN PUBLICATIONS LISTED IN THE TEXT

Year	Total pages	Approximate per cent. of total pages given to				
		Systematic botany	Morphology	Physiology	Ecology	Pathology
1881	259	85				
1890	640	61	5	2		24
1900	1,925	34	9	5	1	33
1910	3,342	33	8	6	6	11
1920	4,437	9	11	18	6	29
1930	3,841	10	13	26	1	41

Taking 1881 and the succeeding decimal years as examples we find that of the 259 pages published in 1881, 85 per cent. was systematic botany, including work on local floras. In 1890, of a total of 640 pages, systematic botany made up 61 per cent., pathology 24 per cent., all about diseases due to fungi, morphology 5 per cent. and physiology 2 per cent. In 1900 there was a total of 1,925 pages, of which systematic botany occupied only 34 per cent., morphology and physiology 9 and 5 per cent., respectively, while there was 1 per cent. of ecology and 33 per cent. pathology. The figure for ecology is unusually low and that of pathology unusually high, as 1900 seems to have been an exceedingly favorable year for pathology. Ten years later, out of a total of approximately 3,300 pages, 33 per cent. was systematic botany and 8 per cent. morphology, about 6 per cent. each physiology and ecology and 11 per cent. pathology. In 1920, of a grand total of 4,437 pages, systematic botany made up less than 10 per cent., morphology 11 per cent., physiology 18 per cent., ecology 6 per cent. and pathology 29 per cent., two thirds of which was about fungus diseases. Last year, out of a total of 3,841 pages, systematic botany had about 10 per cent., morphology 13 per cent., physiology 26 per cent., and pathology showed 41 per cent. The apparent slump in ecology is largely due, no doubt, to the establishment of an independent journal for papers in this branch of botany and zoology.

What causes these differences? Why, for example, do systematic papers make up only about 10 per cent. of the total botanical material which appears in these standard journals? I realize, of course, that many good systematic papers appear outside these series and that the decline is in part relative, but no one will contend that systematic botany occupies anything like the position it did fifty or even thirty years ago. No one will maintain either that the necessity for systematic work is past. Nor am I convinced that brains capable of serious taxonomic studies are no longer produced in America. I have heard various reasons advanced to account for this obvious decline, among others, that the systematists have made themselves ridiculous by describing numerous scarcely distinguishable "species" by endless changing of names and bickering about nomenclatorial rules. It has also been argued seriously by competent botanists that taxonomic work has been rendered more or less futile by the concept of evolution and that systematic botany depends for its existence on a belief in the fixity of species. However much weight these considerations may have, it seems to be the fact that taxonomy is out of fashion just as truly, if not quite so completely, as snuff.

The question just raised may fairly be reversed and injury made as to why morphology, physiology and pathology did not occupy larger places in Ameri-

[2] The paper was illustrated by a series of charts showing the volume of publication on various phases of botany during the period 1881 to 1930. The general trend of these curves is indicated in the text with sufficient detail to be easily followed by any one familiar with American botanical literature.

can botany in 1881. From a much longer list I will cite a number of discoveries or lines of work published between 1859 and 1869 well within the range of facilities then available in the United States and sufficiently striking to have deflected a substantial fraction of botanical interest but for the existence of strong inhibiting influences.

1859 The "Origin of Species," from which the study of structural adaptations, mechanisms of pollination, distribution of seeds, and related problems received a great impetus in Europe.

1861 Pasteur's discovery that yeast and several species of bacteria were able to live in the absence of oxygen.

1863 Max Schulze's demonstration of the identity of protoplasm of plants and the so-called "sarcode" of the animal physiologists.

1863 Work of Sanio on the process of secondary thickening of the axis of the Dicotyledons and Conifers.

1864 De Bary's demonstration of the heteroecism of the stem rust of wheat.

1860–5 Sachs' work on photosynthesis and especially the application of the iodine test for starch.

1865 Darwin's study of climbing plants.

1866 Sachs' great work, "Experimental-physiologie der Pflanzen," was published. Yet plant physiology did not get fairly under way in the United States until about 1890.

1867 Hildebrandt as a result of crossing yellow and a dark brown race of maize noticed xenia, although he did not call it by that name.

1868 The first edition of Sachs' "Lehrbuch."

1868 Williamson's first memoir on the coal measures.

1869 Darwin's work on heterostylism.

To the question as to why physiology was not more vigorously pursued in the United States fifty or sixty years ago, one is tempted to repeat that it was out of fashion at that time. Possibly the Victorian botanical mind recoiled instinctively from the study of the life processes and sexuality of plants. Speaking more seriously, the influences which kept American botany in the face of all this distraction almost exclusively on the single track of the taxonomy of flowering plants must have been profound. First of all, of course, was the exploration urge. We were then at the period when the finding of new things in the field took precedence over all other activities, but together with this, emphasizing it and, I believe, extending the period, was the influence of Asa Gray, who, for a period of over thirty years, dominated American botany more completely than any one botanist is likely to again. So complete was this domination that even the systematic study of the lower forms of plant life was almost crowded out of the picture.

The story of the change from this condition, which you may designate as the emancipation from the fetters of the herbarium or, if you prefer, the degeneration of American botanical science, is perhaps more easily traced in the graphs showing pages of publication. And this may be a good time to emphasize again that I am not discussing facts but conceptions, not value of publications but volume of publications.

Physiology, morphology and pathology are all represented, although, of course, very scantily in the first year included in this review. The first to expand markedly was pathology. The flood of papers on plant pathology, especially on diseases due to fungi, followed closely on the perfection by Koch of the plate method of isolating bacteria and fungi, and the discovery by Millardet in France, of the effectiveness of copper and lime as an agent in the control of downy mildew of the grape. Whether we have passed the crest of the curve of production of print on fungus diseases is, of course, problematical. But no doubt some of our colleagues would warmly welcome such a change and there are some indications of its approach. It may be a sign of the times that whereas we used some years ago to hear from mycologists much of the importance of mycology to phytopathology, the summer of 1930 found them insisting at Cambridge that mycology was entitled to consideration in its own right wholly independent of plant pathology.

The story of the rise of physiology, morphology and cytology in the United States is largely the story of the importation, belated importation, perhaps, and the development here of botanical conceptions and methods already under way in Europe. In 1888 or 1889, both physiology and morphology entered on a period of expansion which became more marked nine or ten years later. Ecology claimed a place in the American sun in the year 1899, three years after the publication of Warming's great work. The "Sem Bot" of the University of Nebraska was engaged in a study which would have led to ecology before 1892, but the cumbersome term they employed, "phytogeography," stood no chance against the shorter term, "ecology."

However, I am less concerned now with these large waves of interest than with the smaller wavelets which may fairly be designated as fads. I might point out, for example, that in the control of plant diseases we have passed through, during the last fifty years, a Bordeaux period, a lime sulfur period, a dusting period, and are now in an eradication and quarantine period. Of course Bordeaux and lime sulfur are still used, but they are no longer talked about. Our most recent pathological fad is obviously that on virus diseases, which was launched by the work of Allard, 1913 and 1914, and reached what may be a crest in 1926.

Nor are other branches of plant science free from the influence of fads. Among American morphological publications during the period under discussion, two conspicuous fads may be mentioned. The embryo sac fad which began about 1894 or 1895 and continued to show considerable activity through 1916, but is now apparently practically over, and the chromosome fad, which got fairly under way in 1897 and 1898, following Strasburger's great generalization regarding the different numbers of chromosomes in the two generations of a plant, slumped to almost nothing in 1916–17–18, and is now enjoying a second run of popularity due apparently to the discovery that there is a connection between the number of chromosomes and the possibility of producing fertile hybrids in certain genera.

In recent physiological papers the most noticeable fads, at least to the outside observer, are the study of hydrogen-ion concentration and the study of light relations. This last started by the publications of Garner and Allard on the relation between duration of daily illumination and reproduction of certain plants.

Are these Waves of Interest Fads?

Webster defines fad as a "hobby, whim, custom or amusement followed for a time with exaggerated zeal."

The International Dictionary elaborates this somewhat and defines a fad as "a trivial fancy adopted and pursued for a time with irrational zeal; a matter of no importance, or an important matter imperfectly understood, taken up and urged with more zeal than sense." I leave you to judge of the correctness of the term, but I can find no better English word.

What Starts a Fad?

In the first place it seems to me, that in order for a real fad to start the stage must be set. Apparently there is no great chance of a fad taking hold close on the heels of another one. It must wait until the collective botanic mind, or rather a portion of the botanic mind, has reached a condition approaching saturation. Note, for example, that the virus disease fad came to the relief of the phytopathologists, as fungus disease publication was approaching 900 pages a year and that ecology came into the United States when taxonomic work was getting close to 1,000 pages a year. Ecology seemed to offer a man with systematic instincts a chance to do a little systematic work without being too critical about the literature and synonomy, and to do some local flora work under a new and attractive name.

Given a favorable stage setting, the fad seems to be started by some discovery, paper or suggestion which is sufficiently different from the common run of good botanical matter to attract attention, but not sufficiently different to prevent its being readily understood. I may say, here, that I find the name of but one man connected with the inception of more than one fad. This is, of course, our fellow Washington botanist, H. A. Allard. I am credibly informed also that Allard is responsible for starting fads in the study of the synchronization of the stridulation of certain insects and the flashing of fireflies. Needless to say, I await with interest what this original mind will start next.

The Next Fad

I will not even venture to predict what the next fad will be. If I knew I should get out a paper on the subject immediately. A year ago I felt that we were well on our way to a fad for the study of peat bogs by the method of pollen analysis. But this, perhaps because it savors of fossil botany, seems to be thriving better in Europe than America.

Some Potential Fads that Failed to Materialize

It is, of course, perfectly possible for an outstanding, even a striking, achievement which attracts a good deal of attention to fail to produce a fad. I have never understood why Blakeslee's discovery of sexuality in the mucors did not start a fad. "Physiologically balanced solutions" and "antagonism," which were words to conjure with in 1906 and 1908, seem not to have caught the botanical imagination as did "length of day." "Carbo-hydrate-nitrogen-ratio" apparently started no such fad as did "hydrogen-ion concentration." One might reasonably have expected the outstanding success of Dr. Coville in developing the native blueberry and thus creating a new industry in the "barrens" of New Jersey to have aroused great interest in our uncultivated native fruits, but there seems to have been no great increase in such interest.

There are apparently certain lines of botanical investigation which have never taken very vigorous root in American soil. Notable among these is, of course, paleobotany, which, in spite of a few very distinguished workers and a wealth of available material, has never assumed a large place in American botanical work.

What Stops a Fad?

The real answer to the question of why fads stop is that they do not, they merely cease to be fads, that is, each of them leaves some more or less permanent imprint or, to change the figure, influences the course of botanical thought. On the other hand, we certainly do lose most of our interest in subjects before they become exhausted. One explanation which Professor S. W. Williston used to urge with some heat was that it was easier to pick up a new line than to

master the literature of an old one. Twenty years ago he predicted that ecology would become as unpopular as taxonomy as soon as the literature was sufficiently voluminous.

You have all heard the students of taxonomy, both animal as well as plant, express grief, even exasperation, that so little attention is paid to their work. I can see no help for this. Neither last summer could the owners of "Tom Thumb" golf courses find any way to bring back the patrons who thronged their courses in 1930. I would urge those who find themselves almost deserted in a no longer fashionable field of botanical effort to cease railing against fate, for, to quote Justice Holmes:

> The law of fashion is a law of life. The crest of the wave of human interest is always moving, and it is enough to know that the depth was greatest in respect of a certain feature or style in literature or music or painting a hundred years ago to be sure that at that point it no longer is so profound. I should draw the conclusion that artists and poets, instead of troubling themselves about the eternal, had better be satisfied if they can stir the feelings of a generation, but that is not my theme.

The Dangers of the Fad

The dangers of the fad are obvious. All investigators are possessed more or less with what some one has called "the devil of one idea." When a group is so possessed we get something very like mob psychology, which results in an inevitable bias in observation and publication. Illustrations of this will occur to each of you. Many of you will recall—at least from the reproductions in early editions of Wilson's book the "Cell"—that Guiginard described and illustrated centrosomes in the lily. It was soon apparent, or at least generally believed, that no such structures exist, but under the impulse of the fad for centrosomes they appeared real enough to this cytologist.

Some of you will recall or have noted in the literature that Dr. T. J. Burrill, honored wherever pathology is studied as the first to demonstrate the possibility of bacterial disease in plants, described,

> *Micrococcus toxicatus*, Burrill. Cells globular, single and in pairs, rarely in chains of several articles; .00002 in. in diameter; movement oscillatory only.

This organism he believed to cause the poisonous principle of species of Rhus and to be capable of penetrating the human skin and inducing the peculiar inflammation which takes place. So enthusiastic was Burrill over this imaginary discovery that he published it in three different places. Those who in 1922 saw the unrestrained enthusiasm of the recognized leaders of plant pathology over the preliminary and possibly mistaken announcement of certain organisms in the cells of plants affected with mosaic diseases were witnessing no new phenomenon. Similar enthusiasm, if I may judge from the literature, greeted the alleged bacteria in poison ivy forty years earlier. In one of the great speeches of all time, Paul, standing on Mars Hill, is said to have addressed an audience "who spent their time in nothing else but either to tell or to hear some new things." This is a condition not wholly foreign to other audiences in other times, even American botanical audiences.

The danger in this sort of publication is, however, more apparent than real. A wise and tolerant botanical public, realizing that these great investigators were acting under the impulse of "fad psychology," soon forgets these slips, and the careful reader of tomorrow, noticing in the pathological literature of 1915 to 1925 an exceedingly large number of reports of virus diseases, will recall that virus diseases were all the rage in those days and will take these reports with more than a grain of salt.

Just as a man in good general health who consulted a physician between 1910 and 1920 was predestined to be diagnosed as having appendicitis, so a plant which showed any unusual abnormality between 1915 and 1925 was sure to be under suspicion of having some mosaic disease. Five years ago we were busily studying two diseases of strawberries which we regarded as of virus origin. One has since turned out to be caused by nematodes and the other is apparently a genetic variation.

The Advantages of the Fad

A year ago I was convinced that fads, at least botanical fads, were an almost unmitigated nuisance. Somewhat more mature reflection, however, serves to convince me of the contrary. I now regard them with a toleration which approaches enthusiasm.

Something like a fad may be necessary to jar the human mind, even the botanical mind, from its old moorings. To cast out the devil of one idea from the botanical mind is often a decided advance. It may be that occasionally, when the devil of one idea is cast out he will return, and finding the botanical house swept and garnished, take seven other spirits worse than himself and enter in and dwell—which might appear worse. On the other hand, it may really be better, and at any rate they will not stay. New fads are often better than the old. I am glad, for example, that the fad for chewing tobacco has been replaced by the cigarette fad. I view with something very like dismay the possibilities if the ladies had all taken up tobacco during those earlier days. With almost equal dismay I view the possibilities if changes in American botanical interests had ceased at, for example, the embryo sac stage.

It may well be that the fad offers the only way to really introduce a new concept into the botanical world. By this I do not mean merely to get the idea into literature, but to get in into botanical thinking.

In his "Leaven of Science" Sir William Osler cites the following story, told by Sir Robert Christian, about Barclay, one of the leading anatomists of the early part of the nineteenth century. Barclay spoke to his class as follows:

> Gentlemen, while carrying on your work in the dissecting room, beware of making anatomical discoveries; and above all beware of rushing with them into print. Our precursors have left us little to discover. You may, perhaps, fall in with a supernumerary muscle or tendon, a slight deviation or branchlet of an artery, or, perhaps a minute stray twig of a nerve—that will be all. But beware! Publish the fact, and ten chances to one you will have it shown that you have been forestalled long ago. Anatomy may be likened to a harvest field. First come the reapers, who, entering upon untrodden ground, cut down great stores of corn from all sides of them. These are the early anatomists of modern Europe, such as Vesalius, Fallopius, Malpighi and Harvey. Then come the gleaners, who gather up ears enough from the bare ridges to make a few loaves of bread. Such were the anatomists of last century—Valsalva, Cotunnius, Haller, Vicq d'Azyr, Camper, Hunter and the two Monroes. Last of all come the geese, who still contrive to pick up a few scattered grains here and there among the stubble, and waddle home in the evening, poor things, cackling with joy because of their success. Gentlemen, we are the geese.

Osler's comment on this story is:

> Yes, geese they were, gleaning amid the stubble of a restricted field, when the broad acres of biology were open before them. Those were the days when anatomy meant a knowledge of the human frame alone; and yet the way had been opened to the larger view by the work of John Hunter, whose comprehensive mind grasped as proper subjects of study for the anatomist all the manifestations of life in order and disorder.

To Osler's comment I beg leave to add that probably only by strength of interest in various fads were the geese called away from their gleanings and but for the widening of interest induced by fads they and their successors might well have remained in the stubble.

OBITUARY

WICKLIFFE ROSE[1]

1862–1931

WICKLIFFE ROSE was educated in his native state of Tennessee and at the University of Chicago. The scope of his intellectual interests was manifested early and changed only in outward appearance as time and circumstances carried him into unfamiliar and unexpected fields. It is worth noting that his first teaching position was in history and mathematics—subjects which, while disparate in content, were yet both congenial to his mind. It was in philosophy, however, that he found his real vocation. He filled chairs of philosophy and the philosophy of education for more than ten years at Peabody College and the University of Nashville. Never afterwards did he lose the general and analytical point of view acquired in those formative years. In all his subsequent, varied activities he looked instinctively not only into, but around, his problems.

During this period his recognized talents, executive ability and devotion to education led to his selection as dean of Peabody College and the University of Nashville, as agent of the Peabody Fund and trustee of the John F. Slater Fund, both the latter appointments having to do with furtherance of education in the South.

It was doubtless while administering these funds that Dr. Wallace Buttrick, president of the General Education Board, came to know Dr. Rose and to appreciate his gifts. Thus it resulted that Dr. Rose was chosen in 1910 to be the director of the Rockefeller Sanitary Commission for the Eradication of Hookworm in the South, an undertaking which started him on the amazing career for the betterment of health and the upbuilding of science that was to assume world-wide dimensions.

It was not without trepidation that Dr. Rose entered upon the anti-hookworm campaign. The field seemed far removed from philosophy and education. He gave the opportunity minute thought and consideration, and it may well be believed that his natural humanitarian impulses and love of his country contributed to the affirmative decision. A wakeful night, it is said, brought conviction and yielded also a plan of operations. As many of us know the dangers and pitfalls of midnight vigils, it is proper to state that Dr. Rose's visions when tested proved to be realizable. It is an historical fact that the methods he put into practice at the outset later called for little modification even when applied on an international scale.

There was a critical moment in the year 1910 when Dr. Rose might have been lost to the great career

[1] Read at the meeting of the National Academy of Sciences, Washington, D. C., April 26, 1932, at the posthumous award on Dr. Wickliffe Rose of the Marcellus Hartley medal for eminence in the application of science to the public welfare.

awaiting him in the yet distant future. When the presidency of Peabody College was offered him, his heart returned to his first loves—philosophy and education. The decision to be made was difficult and had to be a final one. We met at Lake George, where, as I recall it, the Southern Education Board was in session. Dr. Rose, who was at home on the water, rowed me well out on Lake George, and then resting the oars told of his struggle. Tears came into his eyes as he described the pull of the old, academic life, and also the attraction of the opportunity for useful work just opening before him. My sympathies were deeply stirred, and I rejoiced when I felt that Dr. Rose would go on with the health project. No one could, of course, advise the choice, although the extraordinary future in store for him had already become apparent to his associates.

A notable authority has said that Dr. Rose was a pioneer in devising the best methods of applying private philanthropy to the problems of preventive medicine. The tribute may justly be broadened: he was equally a master in the difficult art of applying private philanthropy to the highest purposes of scientific education and research. The beginning was made in public health work, and for this hookworm eradication was the instrument. Here it was necessary to proceed with tact and caution. The sensibilities of states were aroused. Dangers were averted by the policy adopted at the outset of entering a field only upon the invitation of the government, to operate as an integral part of the constituted health authorities, to exalt the importance and efficiency of the official health agencies, and to avoid all appearance of outside intrusion.

These, which have proved to be sound principles, rested in their successful application on knowledge of the extent of hookworm infestation, of the terrain which differed with locality, the economic status of the region, and on a fundamental understanding of the biology of the hookworm and the best available methods for its eradication.

Here were scientific questions to be answered and problems to be solved—things very appealing to Dr. Rose's mind. The relief work was gotten quickly under way, and very soon the scientific studies followed. The booty was a wealth of new facts, and in time the mere eradication of hookworm infestation became the wedge for the enlargement of public health activities and the undertaking of scientific investigations in the field and laboratory of public health problems.

The difficult matter of a personnel trained for scientific public health work became increasingly pressing. The solution sought by Dr. Rose was characteristic of him. Looking ahead a long time, he saw public health officers of various kinds as constituting a virile force in modern civilization. Thus he became the prime mover and influence in leading the Rockefeller Foundation to create schools of hygiene, with large funds, in Baltimore, Boston, London and elsewhere. The results of this vast public health program, which was extended to more than fifty countries and nations often diverse in populations and local conditions, with adaptations suited to each, have been astounding as measured in health, wealth and good will.

In due time an attack on malaria was begun, first on a local and later on an international scale. Here again scientific studies preceded or went hand in hand with practical relief operations. And then came the great problem of yellow fever in the Western Hemisphere and in Africa. It is not, I think, too much to say that next to Walter Reed and his associates the world owes most in this respect to the fundamental conceptions of Wickliffe Rose. Employing scientific expeditions sent to the "seed beds" of the disease in order to establish its nature and if possible to discover its cause, and by bringing into play the resources of present-day science, he is responsible for Dr. Noguchi's discovery of the *Leptospira icteroides* and Dr. Stokes' discovery of the African virus of yellow fever. It now appears that the yellow fever of the Western Hemisphere is dual in character, being composed of two diseases—one produced by the leptospira, the other by an agent identical with the African virus. This discovery promises to have far-reaching implications in the efforts to eradicate the Western disease.

As is well known, the two intrepid investigators just mentioned, as well as still other scientists, lost their lives in the course of their studies on yellow fever. Out of these profound tragedies has already come a means of protecting laboratory workers from infection by a method of immunization which may prove to have great importance for the future.

In 1923, when Dr. Rose became president of the General Education Board and the International Education Board, he returned to the educational field. Applying his accumulated experience, he set to work at once in the building up of science in its teaching and research aspects, and addressed himself again to the essentials of the undertaking at home and abroad. Knowing the value of good counsel, he sought to obtain the best available. The resources at his command were large; he knew the value of conservation and of use. Characteristically he struck again at the root of opportunity. Seeking to advance knowledge, his method was to strengthen the strong; he was attracted to leading men, strong laboratories, present opportunity. His aid was given widely but irregularly, as the circumstances seemed to warrant. In

every instance, first a survey and then an analysis were made. After due consideration, fortified by conference, judgments were reached. When action came, it was decisive and often courageous. Magnitude with him was a wholly relative matter: he weighed his acts in results to be achieved, rather than in costs to be met. Moderate expenditures were the rule, but large ones, as notably for the erection of the great two hundred inch telescope building at Pasadena, did not daunt him.

Although he was not a technical scientist, Wickliffe Rose became a great force in science. The temper of his mind was essentially scientific and he found no difficulty in dealing with scientists on their own grounds. I believe that he never discerned a problem in an unscientific manner; surely he never entered upon a project which he did not comprehend fully. It may be said of him that he enriched every field in which he worked; this is true of hookworm disease, malaria, yellow fever, and of the aid, small and large, which he gave to physics, chemistry, astronomy and biology.

In an interlude to his constructive activities he rendered valuable service as chairman of the War Relief Commission of the Rockefeller Foundation. In Belgium, Poland, Serbia and other countries ravished by war the assistance given under his direction to refugees, children and the destitute is gratefully remembered. He was responsible for the creation of the hospital unit at Compiègne where Drs. Carrel and Dakin worked out their method of treating infected wounds which played so beneficent and large a part in the late years of the war and afterwards in civil life.

Dr. Rose was remarkable in his self-effacement. No man, I believe, was ever more successful in this respect. He was moved by the opportunity for human betterment—of health, of knowledge, of personal relations. To those of us privileged to work beside him he was a constant wonder and joy. The ideality of his purpose, the clarity and comprehensiveness of his vision, the lucidity of his exposition, the security of his judgment, his good companionship, his love of a good story (especially a fish story, for he was an enthusiastic fly fisherman)—these are things not to be conveyed in mere words.

SIMON FLEXNER

MEMORIALS

THE annual meeting of the Research Club of the University of Michigan each year honors the work of some leader of science whose birth occurred one hundred years ago or some multiple thereof. The meeting on April 20 was a memorial to Benedictus de Spinoza and Anthony van Leeuwenhoek. The paper on Spinoza was read by Professor DeWitt H. Parker, of the department of philosophy; that on van Leeuwenhoek by Dr. C. V. Weller, head of the pathological laboratories. President Alexander G. Ruthven discussed the importance of research to the university.

THE *Zeitschrift für Tuberkulose* has published a special Robert Koch issue containing his portrait and two facsimile letters, as well as original papers by E. von Romberg and Sauerbruch, each of Munich; Sir Robert Philip, of Edinburgh; Calmette and Léon Bernard, of Paris; Bruno Lange, of Berlin; Bang, of Copenhagen, A. Stanley Griffith, of Cambridge, and others.

THE fourth "Victor Horsley Memorial Lecture" will be delivered this year, and the trustees (who consist of the presidents of the Royal Society, the Royal College of Surgeons of England, and the British Medical Association, the senior physician to the National Hospital, Queen Square, the senior surgeon to University College Hospital, and Mr. Stanley G. Robinson, the son-in-law of Sir Victor Horsley) have invited Professor E. D. Adrian, of the University of Cambridge, to give the lecture, and he has consented to do so. The lecture will be delivered on July 20 on the subject of "Visceral Sense Organs."

RECENT DEATHS

PROFESSOR JAMES W. TOUMEY, a member of the faculty of the School of Forestry at Yale University since it was established in 1900, formerly dean of the school, died suddenly on May 6, at the age of sixty-eight years.

DR. CHARLES DWIGHT MARSH, formerly physiologist in the U. S. Bureau of Animal Industry, died in Washington on April 23, at the age of seventy-seven years.

DR. WILFRED W. SCOTT, head of the department of chemistry at the University of Southern California, died suddenly on May 3, at the age of fifty-six years.

DR. T. C. JOHNSON, horticulturist and director of the Virginia Truck Experiment Station, died on March 31, at the age of sixty-two years.

THE death is announced at the age of thirty-three years of Dr. George Janssen, assistant professor of agronomy and assistant agronomist at the Experiment Station at the University of Arkansas.

Nature reports the deaths of Professor W. R. Dron, Dixon professor of mining in the University of Glasgow; of Dr. Alfred Hay, sometime professor of electro-technology, Royal Indian Engineering College, Coopers Hill, and afterwards at the Indian Institute

of Science, Bangalore; of Professor G. M. Robertson, professor of psychiatry in the University of Edinburgh; of Eustace Short, of the firm of Short Brothers, a pioneer in the design and construction of aeroplanes, and of Professor A. L. Urquhart, professor of pathology at the University of Cairo.

SCIENTIFIC EVENTS

THE YORK MEETING OF THE BRITISH ASSOCIATION

THE annual meeting of the British Association for the Advancement of Science will be held this year at York from August 31 to September 7. The president is Sir J. Alfred Ewing and he will deliver an inaugural address on the subject of "An Engineer's Outlook."

The London Times calls attention to the circumstance that the British Association had its beginning at York. It is recalled in the preliminary program for this year's meeting that when David Brewster in 1831 made the first concrete proposal for the foundation of a "British Association of Men of Science" he addressed it to John Phillips, the secretary of the Yorkshire Philosophical Society, on the grounds that York was centrally situated for a general meeting such as was contemplated and that the society already established there was flourishing and well managed. In the premises of the Yorkshire Philosophical Society, accordingly, the association was brought to birth on September 26, 1831, and continued its meetings on the following days.

The subjects of papers read depended largely upon the chance of individual men of science attending the meeting coming prepared with something to say, but the classification is not without interest. Six of the communications were on geology and mineralogy, five on magnetism and electricity, four on optics, three on light and lighting, while three were physiological, two meteorological, two chemical and one astronomical. Since 1831 the association has met at York in 1844, 1881 and 1906, and it returns to the city this year for the first meeting after the celebration of a century of existence.

The arrangements made for the 1932 meeting, according to the *Times*, include the presidential address in the Section of Mathematical and Physical Sciences by Professor O. A. Rankine on "Physics in Prospecting for Minerals"; there will be discussions on the control of humidity in industrial processes, the quantitative relation of physical stimuli and sensory events, super conductivity and short-wave reception by frame aerials. Dr. W. H. Mills will preside over the Chemistry Section and give an address on "Some Aspects of Stereo-chemistry." In the Geology Section the presidential address by Professor P. G. H. Boswell will be on "The Contacts of Geology: The Ice Age and Man." The president of the Section of Zoology will be Lord Rothschild. Professor H. J. Fleurs will give a presidential address in the Geography Section on "The Geographical Study of Society and World Problems." There will be papers in the Section of Economic Science and Statistics on the location of industries, the effects of the world depression on the banking systems of Central Europe, and the economic position of Japan. The address of the section president, Professor R. B. Forrester, will be on "Britain's Access to Overseas Markets."

Professor Miles Walker is to preside over the Engineering Section, and give an address on "The Call of the Engineer to Manage the World." In the Anthropology Section the presidential address by Dr. D. Randall MacIver will deal with "The Place of Archeology as a Science." Other sectional presidential addresses will be as follows: Psychology—Professor Beatrice Edgell on "Current Constructive Theories on Physiology." Botany—Professor J. H. Priestley on "The Growing Tree." Educational Science—Mr. W. M. Heller on "The Advancement of Science in Schools." Agriculture—Professor R. G. White on "Sheep Farming; a Distinctive Feature of British Agriculture." Sessions of the Physiology Section will not be held at York, as the fourteenth International Physiological Congress is being held at the same time at Rome.

Two evening discourses have been arranged. Sir Arthur W. Hill will speak on "Plant Products of the Empire in Relation to Human Needs," and Mr. C. C. Paterson will deal with "Uses of the Photo-Electric Cell." There will also be a public lecture by Mr. H. E. Wimperis on "Speed in Flight." The Lord Mayor and the Sheriff of York will hold an evening reception on September 1.

WESTERN RESERVE CHAPTER OF SIGMA XI

THE fifty-ninth chapter of Sigma Xi has been installed at Western Reserve University. The chapter will assume the functions of the Science Colloquium, an informal scientific club which has been active in the university for many years.

Owing to illness, Dr. L. B. Wilson, national president, was unable to be present and the ceremonies were conducted by Professor Leon J. Cole, of the University of Wisconsin, and Professor Edward Ellery, na-

tional secretary. The installation ceremony was held in the Institute of Pathology, and was followed by a banquet at the Wade Park Manor Hotel and by an evening meeting in the auditorium of the Allen Medical Library addressed by President Wickenden, of the Case School of Applied Science.

Six members of the faculty were initiated to full membership. Two others were elected but were unable to be present for initiation. Fifty-eight members from other chapters now on the Western Reserve faculty affiliated themselves as charter members of the new chapter.

The officers elected for the first year are:

President, V. C. Myers.
Vice-President, H. S. Booth.
Secretary, J. A. Doull.
Treasurer, A. H. Hersh.
Membership Committee: (3 years), F. J. Bacon and T. Sollmann; (2 years), F. Hovorka and H. T. Karsner; (1 year), H. W. Mountcastle and J. R. Musselman.

At the installation meeting, following the presentation of the charter and the initiation of new members, Professor Cole gave a brief address on the history of the society and its objectives. This was followed by a symposium on methods of achieving the purposes for which Sigma Xi was organized. At the banquet short addresses were made by President Emeritus Thwing, President Vinson and Professor Cole. The subject of President Wickenden's address at the evening meeting was, "Science in a Changing World."

STATE ACADEMIES OF SCIENCE

THE Kansas Academy of Science held its sixty-fourth annual meeting at McPherson College, Kansas, from April 14 to 16. The program listed 114 papers of which over 100 were read. The attendance was about 250, not including local students. Professor L. E. Melchers, head of the botany department of the Kansas State College, gave a lecture on "The Oases of the Libyan Desert." At the banquet the presidential address was given by Dr. Roger C. Smith, of the Entomology Department of Kansas State College. His subject was, "Upsetting the Balance of Nature with Special Reference to Kansas and the Great Plains Region." There was an illustrated public lecture on "Tamest Africa," by Dr. S. A. Barrett, director of the Milwaukee Public Museum. The following officers were elected: Robert Taft, University of Kansas, Lawrence, *president;* J. Willard Hershey, McPherson College, *first vice-president;* Wm. H. Matthews, Kansas State Teachers College, Pittsburg, *second vice-president;* George E. Johnson, Kansas State College, Manhattan, *secretary;* Harvey A. Zinszer, Fort Hays Kansas State College, Hays, *treasurer.* The chairman of sections elected were: John Breukelman, Kansas State Teachers College, Emporia, biology; J. W. Hershey, McPherson College, chemistry; J. L. Bowman, McPherson College, physics; H. B. Reed, Fort Hays Kansas State College, psychology; R. H. Painter, Kansas State College, Manhattan, entomology; Hazel E. Branch, University of Wichita, Junior Academy. Additional members of the executive council are: R. C. Smith, Kansas State College; Wm. J. Baumgartner, University of Kansas; E. A. Marten, University of Wichita. Dr. F. C. Gates, Kansas State College, was reappointed editor.

GEORGE E. JOHNSON,
Secretary

The tenth annual meeting of the Virginia Academy of Science was held at Hollins College on April 21, 22 and 23. Six hundred registered and 120 papers were read. The invited speaker for the open meeting Friday night was Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, who spoke on "The Evolution of the Research Laboratory." The prize of fifty dollars, which is awarded each year for an especially meritorious paper read at the meeting, went to Dr. James H. Smith, of the Medical College of Virginia, for a paper entitled "The Influence of Solar Radiation on the Distribution and Prevalence of Exophthalmic Goiter in the United States." Professor F. J. Sette, of the Virginia Polytechnic Institute, was given a certificate for a paper entitled "A Study of the Pulaski Reservoir." The newly formed Section of Medical Sciences, organized by Dr. J. Shelton Horsley with its 80 members and a program of twenty papers, attracted especial attention. Dr. T. McN. Simpson, of Randolph-Macon College, was elected president for the coming year and Professor Ida Sitler, of Hollins College, to membership on the council.

E. C. L. MILLER,
Secretary-Treasurer

In connection with the twenty-fifth annual meeting of the Illinois Academy of Science, which convened at the University of Chicago on Friday, May 6, there was held by the section of anthropology a symposium on the prehistoric races of Illinois. Dr. A. R. Kelly, head of the department of anthropology at the University of Illinois, presided as chairman of the section, and also presented a paper dealing with archeological discoveries in the Cahokia Mounds region near St. Louis. Fourteen students of Illinois prehistory took part in the program, among them Dr. Fay-Cooper Cole, president of the academy and head of the department of anthropology and archeology at the University of Chicago. Dr. Cole spoke on "Field Meth-

ods Employed in Mississippi Valley Archeology" with special reference to past work in Illinois. The Academy of Science maintains separate sections in agriculture, anthropology, botany, economics, geography, geology, medicine and public health, physics and chemistry, psychology and education, and zoology, all meetings being open to the public. A banquet was held on Friday evening at the Shoreland Hotel, after which Dr. Cole delivered the annual public address of the retiring president on "The Coming of Man." On Saturday morning an inspection was made of the new Oriental Museum at the University of Chicago, and also of the Field Museum, the Adler Planetarium and the Shedd Aquarium group in Grant Park.

GEOLOGICAL SESSIONS AT THE SUMMER MEETING OF THE AMERICAN ASSOCIATION

SECTION E will hold sessions during the summer meeting of the association at Syracuse, New York, between Tuesday, June 21, and Friday, June 24. Arrangements for the sessions are being made by Dr. George B. Cressey, Syracuse University, local representative for Section E. On Tuesday there will be a joint session with Section M, consisting of a symposium on aerial photography and aerial mapping. Section E will also participate in the symposium dealing with land use, which is being arranged by the general committee for the Syracuse meeting. The Wednesday morning session will be devoted to papers on local physiography, including glaciation. In the afternoon a field trip will be taken to points of physiographic interest. On Thursday morning, in addition to general papers, there will be a number of reports on stratigraphy related to the classic New York section. In the afternoon a field trip will be arranged especially for stratigraphers. Friday, June 24, will be devoted to an all-day field trip in the Mohawk Valley and the Adirondacks.

Those who desire to present papers should send titles to the secretary promptly. Titles must be accompanied by abstracts of about 250 words, giving the substance of the paper, and the author should indicate whether he will use lantern slides, charts or other illustrative material. All titles and abstracts must be in the hands of the secretary not later than May 24, if they are to appear on the program.

KIRTLEY F. MATHER,
Secretary, Section E,
Harvard University

SCIENTIFIC NOTES AND NEWS

THE Theodore William Richards Gold Medal was presented to Dr. Arthur Amos Noyes, director of the Gates Chemical Laboratory of the California Institute of Technology, at a meeting of the Northeastern Section of the American Chemical Society in Boston on May 4. The program included a survey of the work of Professor Noyes by Professor Arthur B. Lamb, of Harvard University, president-elect of the American Chemical Society. Professor Lyman C. Newell, of Boston University, gave the history of the medal. William P. Ryan made the presentation and after accepting the medal Professor Noyes spoke on "Education for Chemical Research."

PROFESSOR MICHAEL I. PUPIN, of Columbia University, was recently tendered a testimonial dinner by friends at the Faculty Club, in honor of his having been made an honorary member last summer of the Royal Institution of London. Professor Pupin spoke on "Faraday, the Prophet in Science."

PROFESSOR E. W. BROWN, Stirling professor of mathematics at Yale University, has been made the first incumbent of the professorship of mathematics recently established in honor of Josiah Willard Gibbs.

DR. HELEN DEAN KING, assistant professor in the Wistar Institute of Anatomy and Biology of the University of Pennsylvania, and Dr. Annie J. Cannon, astronomer of Harvard Observatory, have been given jointly the $2,000 Ellen Richards Research Prize awarded annually by the Association to Aid Scientific Research by Women.

AT the annual meeting of the Boston Society of Natural History on May 4, the Walker prize was awarded to Thomas C. Brown, of Fitchburg, Massachusetts, for a paper on the "Glacial Geology of the Nashua Valley," while the second prize was awarded to Kenneth K. Landes, of the department of geology of the University of Kansas, for a paper on "Classification and Distribution of Pegmatites." The following officers of the society were reelected: Charles H. Taylor, *president;* Nathaniel T. Kidder, Glover M. Allen and William M. Wheeler, *vice-presidents;* Clinton V. McCoy, *secretary;* Augustus P. Loring, Jr., *treasurer;* Thomas Barbour, William L. W. Field, Frederic H. Kennard and John C. Phillips, *trustees.* John A. Blanchard and Ralph Hornblower are newly elected as trustees.

PARRY H. MOON, assistant professor of electrical engineering at the Massachusetts Institute of Technology, has been awarded the prize for the best paper presented during the year by the American Institute of Electrical Engineers, northeastern district. The

paper is entitled "Theory of Thermal Breakdown of Solid Dialectrics."

SIR ALDO CASTELLANI, of the London School of Tropical Medicine, is among four recipients of the Mussolini Prize of 50,000 lire (about $2,500) for special distinction in the past year.

Nature writes: "It is fitting that the autumn number (No. 3; 1931) of *Copeia*, a journal of cold-blooded vertebrates published by the American Society of Ichthyologists and Herpetologists, should have appeared as a special tribute to Leonhard Stejneger and his work. For Stejneger is to American cold-blooded vertebrates what G. A. Boulenger is on this side of the Atlantic. Endowed with great personal charm and a willingness to share his profound knowledge, to which the writer of this note has more than once been indebted, Stejneger is a man in whom great diversity of interests and talents has been combined. As Thomas Barbour in a tribute to his friend says, 'Being an antiquarian, a classicist, a rarely accomplished linguist, and a naturalist in the widest sense, he possessed a foundation on which with good health and great industry he has built a mighty structure of rarely excellent work.' The anniversary number, with its many papers on reptiles, amphibians, and fishes, is a fitting monument to this native of Bergen and graduate of the University of Christiania, who since 1882 has been associated with the Smithsonian Institution and since 1911 has been its head curator of biology."

THE following new appointments have been made to the teaching staff of the George Washington University School of Medicine, Washington, D. C.: Errett Cyril Albritton, M.D., professor of physiology and executive officer of the department; Vincent du Vigneaud, Ph.D., professor of biochemistry and executive officer of the department; Leland W. Parr, Ph.D., associate professor of bacteriology; Roscoe Roy Spencer, M.D., associate professor of hygiene and preventive medicine; Chester E. Leese, Ph.D., assistant professor of physiology; John H. Hanks, Ph.D., assistant professor of bacteriology; Elizabeth Verder, Ph.D., assistant professor of bacteriology; George Brewer, M.D., instructor in physiology; Alden F. Roe, Sc.D., instructor in bacteriology; Phoebe J. Crittenden, Ph.D., instructor in pharmacology, and Lane H. Allen, M.S., instructor in anatomy.

DR. CHARLES EDWIN FRILEY has been elected dean of the division of industrial science of the Iowa State College to succeed the late S. W. Beyer. Dr. Friley goes to Iowa from the Texas State College, at which institution he occupied the position of dean of the College of Arts and Sciences.

FRANK H. MOSER has accepted a position as research chemist with the National Aniline and Chemical Company, Buffalo, New York.

DR. KURT KOFFKA, director of the Smith College research laboratory in experimental and educational psychology, has accepted an invitation from the State Institute of Psychology at Moscow to join a Russian scientific expedition to study isolated peoples in remote parts of the country. For the first time a foreigner is included in the personnel of one of the institute's expeditions. Dr. Koffka will lecture at Moscow and at Charkov on his experiments at Smith College.

ACCORDING to the *Journal* of the Washington Academy of Sciences, E. P. Killip, associate curator of plants, U. S. National Museum, who left Washington early in February for study in European herbaria, reports satisfactory results at Berlin. After a month at the Museum d'Histoire Naturelle, Paris, Mr. Killip left for several weeks' work at the Royal Botanic Gardens, Kew, and the British Museum (Natural History), returning to Washington early in May.

J. LELAND MYER, fellow of the Engineering Foundation, who is investigating pure iron for arc welding under Professor Gilbert E. Doan at Lehigh University, has transferred his work to the new laboratory of Professor Gustav Hertz, at Charlottenburg, Germany.

DR. J. BARTELS, who, as a research associate of the Carnegie Institution of Washington, has been engaged on the theoretical interpretation of the accumulated observational data at the Department of Terrestrial Magnetism in Washington, D. C., having completed his year's leave of absence from Germany, has returned to his position in the Forstliche Hochschule in Eberswalde.

A NEW search for Colonel P. H. Fawcett, the English explorer, his son, Jack, and his companion, Raleigh Rimell, reported as lost in the jungle in 1925 while seeking the cradle of Brazilian civilization and now thought by some to be alive, will be undertaken by a British expedition leaving England in June. The expedition, which also will explore Rio das Mortes in the heart of Brazil, will be led by Robert Churchward, who explored the Araguaya River in 1931, and Captain John G. Holman, who was born in Brazil and has spent the greater part of his life as a hunter and engineer in the interior.

PROFESSOR GILBERT AMES BLISS, of the University of Chicago, gave an address on "The Calculus of Variations and Quantum Theory" before the Mathematics Club of George Washington University on April 22.

DR. A. F. BLAKESLEE, of the department of genetics of the Carnegie Institution of Washington, lectured on the inheritance of taste and smell in man, at Goucher College on April 28.

DR. F. M. BECKET, president of the Union Carbide and Carbon Research Laboratories, gave the last Aldred Lecture of the year at the Massachusetts Institute of Technology on May 6. He spoke on the "Development of the Ferro-alloy Industry."

DR. A. POLICARD, Lyons, France, will deliver the eighth Harvey Society Lecture at the New York Academy of Medicine, on Thursday, May 19. His subject will be "Histochemistry: Present State and Future."

AMONG the Friday evening discourses of the Royal Institution, which were resumed on April 22 and continue until June 3, are the following: April 22, Professor J. B. S. Haldane, "Hereditary Transmission of Acquired Characters"; April 29, Professor H. Hartridge, "The Rival Theories of Hearing"; May 20, Professor Henry E. Armstrong, "Faraday at the Sign of the Hexagon," and "Coal Color and Constitution," and May 27, Sir Walter Fletcher, "New Conceptions of Medical Research."

THE District of Columbia Chapter of Sigma Xi is the first non-institutional chapter of the organization to be granted the privilege of electing members. Under the new provision of the national constitution, Dr. Charles Greeley Abbot, secretary of the Smithsonian Institution; Dr. William Alanson White, superintendent of the Government Hospital for the Insane, and Dr. Roy Smith Bassler, curator of geology at the National Museum, were presented with the insignia of the society at the annual meeting on April 26. They responded with brief addresses on their fields of investigation.

AT its recent meeting in Philadelphia the American Society for Experimental Pathology elected the following officers for the coming year: *President,* Dr. Peyton Rous; *Vice-president,* Dr. Carl V. Weller; *Secretary-treasurer,* Dr. C. Phillip Miller, Jr.; *Councilor,* Dr. S. Burt Wolbach; *Councilor,* Dr. Oskar Klotz.

AT the twenty-sixth annual meeting of the American Society of Biological Chemists, held at the University of Pennsylvania, from April 28 to 30, the following officers were elected: *President,* Harold C. Bradley, University of Wisconsin; *Vice-president,* W. Mansfield Clark, the Johns Hopkins University; *Secretary,* Howard B. Lewis, University of Michigan; *Treasurer,* Cyrus H. Fiske, Harvard Medical School; *Councilors,* Paul E. Howe, U. S. Department of Agriculture; William C. Rose, University of Illinois, and D. Wright Wilson, University of Pennsylvania.

AT the recent annual meeting of the Electrochemical Society, the following officers were elected: *President,* R. A. Witherspoon, of the Shawinigan Chemicals Ltd., Montreal; *Vice-presidents,* Duncan MacRae, E. M. Baker and Sterling Temple; *Managers,* Acheson Smith, O. P. Watts and W. S. Landis; *Treasurer,* R. M. Burns; *Secretary,* Colin G. Fink. The convention was well attended and the sessions on fertilizers, copper by-products, and electric furnaces were unusually attractive. Reports from various centers showed increasing activities in the electrochemical industries.

THE council of the Geological Society of America has made the following announcement of nominations for officers for 1933: *President,* Dr. C. K. Leith, professor of geology, University of Wisconsin; *Vice-presidents,* Dr. Elwood S. Moore, professor of economic geology, University of Toronto; Dr. Rollin T. Chamberlin, professor of geology, University of Chicago; Dr. Edward M. Kindle, chief, division of paleontology, Canadian Geological Survey (from the Paleontological Society); Herbert P. Whitlock, curator of mineralogy, American Museum of Natural History, New York (from the Mineralogical Society); *Secretary,* Dr. Charles P. Berkey, professor of geology, Columbia University; *Treasurer,* Dr. Edward B. Mathews, professor of mineralogy and petrography and head of the department of geology, the Johns Hopkins University; *Editor,* Joseph S. Stanley-Brown, Robinson and Company, New York; *Councilors for 1933–1935,* Dr. Frank F. Grout, professor of geology and mineralogy, University of Minnesota, and Dr. W. O. Hotchkiss, president, Michigan College of Mining and Technology; *Representative of the Cordilleran Section,* Dr. Andrew C. Lawson, professor of mineralogy and geology, University of California; *Representative on the National Research Council,* Dr. Donald C. Barton, consulting geologist, chief of the division of the Rycade Oil Corporation. The present members of the council who will serve during 1933 also are Dr. Sidney Powers, chief geologist, Amerada Petroleum Corporation; Dr. Donnel F. Hewett, U. S. Geological Survey; George W. Stose, U. S. Geological Survey; Dr. Frank R. Van Horn, professor of geology and mineralogy, Case School of Applied Science; Dr. Alfred C. Lane, Pearson professor of geology and mineralogy, Tufts College, past president, 1932–1934, and Dr. Reginald A. Daly, professor of geology, Harvard University, past president, 1933–1935.

THE meeting in United States of the sixteenth International Geological Congress, originally planned for the summer of 1932, has been postponed for a year. Circulars with full information concerning the meetings will be distributed by the general secretary of the congress.

THE Pacific Section of the Botanical Society of America will meet with the Pacific Division of the American Association for the Advancement of Science at Pullman, Washington, on June 15, 16 and 17. The sessions will be of the usual type and all members of the society are cordially invited. The society will join with the American Association in its summer meeting at Syracuse. The meeting will be held on June 21, 22 and 23 and will follow the plan of its recent independent summer meetings. No papers will be read. Emphasis will be placed upon field trips and informal demonstrations and discussions. In the field trips the society will join with the Zoologists, the Ecological Society of America, the American Fern Society, the Torrey Botanical Club and others. Visits will be made under competent leadership to areas representative of the rich flora of Central New York. One all-day and two half-day excursions will be made, with an opportunity for the collection and preservation of specimens. In the fields of cytology and physiology it is expected that there will be demonstrations and informal discussion of exhibits.

THE fifth symposium in Theoretical Physics at the University of Michigan will be given in connection with the Summer Session beginning on June 27 and ending on August 19. In addition to other courses in experimental and theoretical physics offered by the Department of Physics, the following special series of lectures and seminars will constitute the symposium: "Selected Problems in Quantum Mechanics," Professor Werner Heisenberg; "Structure of the Atomic Nucleus," Professor George Gamow; "Theory of Hyperfine Structure of Spectral Lines," Professor Samuel A. Goudsmit; "Theory of Band Spectra," Professor David M. Dennison; "Quantum Mechanics," Professor Samuel A. Goudsmit, and "General Colloquium and Theoretical Seminars." A special announcement giving additional information about the work and accommodations may be had by writing the director of the physical laboratory, University of Michigan, Ann Arbor.

THE seventh annual meeting of the Acoustical Society of America was held on May 2 and 3 in the auditorium of the Bell Telephone Laboratories, New York City. At this meeting were reported the latest developments in electrical recording and reproducing of sound and in the acoustic aspects of radio broadcasting. Dr. Leopold Stokowski spoke on "New Horizons in Music" and H. A. Frederick, of the Bell Telephone Laboratories, on "Recent Fundamental Advances in Mechanical Sound Records on Wax Discs." He gave a demonstration using records produced by the vertical cut method. J. P. Maxfield, of Electrical Research Products, Inc., described the acoustic pick-up for broadcasting the Philadelphia Symphony Orchestra. At the Tuesday morning meeting, the following papers were presented: "Acoustics of Broadcasting and Recording Studios," by G. T. Stanton and F. C. Schmid, of Electrical Research Products, Inc., and "Control of Broadcasting Pick-up from Studios," by C. G. Jones and J. P. Maxfield, Electrical Research Products, Inc.

LEADERS in industry representing both large and small concerns will convene at the Pennsylvania State College on May 19 and 20, for the thirteenth annual Industrial Conference sponsored by the School of Engineering. The general theme of the two-day session will be engineering education and the growing need for engineers in the sales and distributing forces of the country. Among the business executives who will participate in the conference will be C. S. Coler, Westinghouse Electric and Manufacturing Company; L. W. Kempton, American Steel and Wire; C. R. Beall, Union Switch and Signal; O. W. Eshbach and Col. R. I. Rees, American Telephone and Telegraph; F. M. Feiker, director of the Bureau of Foreign and Domestic Commerce, Washington, D. C., and Dean Dexter S. Kimball, college of engineering, Cornell University.

THE Fourth International Patents Exposition opened at the Grand Central Palace on May 10 and will close on May 29. The sponsors of this organization, of which Major-General George O. Squier is honorary chairman, and Herman Larson is managing director, have been engaged for several years in collecting all sorts of inventions from all parts of the world. The forthcoming exhibition will be the first to be made in New York, and this will be a forerunner of a more extensive exposition to be made at the World's Fair in Chicago next year.

THE annual Congress of the Royal Institute of Public Health is being held in Belfast from May 10 to 15, under the presidency of the Marquess of Londonderry. The congress has been divided into the following Sections: (I) State Medicine and Municipal Hygiene; (II) Industrial Hygiene; (III) Women and Children and the Public Health; (IV) Tuberculosis; (V) Pathology, Bacteriology and Biochemistry. The inaugural meeting was held in the Great Hall of Queen's University, at 11 A. M. on May 10, when the presidential address was delivered. Several general excursions were arranged, besides sectional visits to hospitals, sanatoria, etc., and certain institutions, centers and works were open for inspection.

DR. C. G. ABBOT, secretary of the Smithsonian Institution, writes: "Dr. T. Wayland Vaughan, director of the Scripps Institution of Oceanography of the

University of California, has solicited the aid of the Smithsonian in rehabilitating the library of the Geological Institute of the Kyoto Imperial University, whose entire collections of specimens and publications were destroyed when that establishment was burned recently. I venture to bring the matter to your attention and to ask whether you will be good enough to insert in SCIENCE an appeal for geological publications for the library of the Geological Institute. Any publications donated for that purpose may be forwarded here for transmission through the International Exchange Service to Japan. Beyond the transportation charges to Washington, which should be prepaid, there would be no cost to the senders of the publications in forwarding them to Japan. Packages should be addressed to "The Smithsonian Institution, International Exchange Service, Washington, D. C.," a letter of announcement being sent to the institution at the time of shipment."

The Museum News reports that a six-story building to be called the Maison Française has been included in the plans for Rockefeller Center, New York. It will occupy the northwest corner of Fifth Avenue and Forty-ninth Street, and will contain four hundred and thirty-seven exhibits on the art, industry and trade of France. In design it will duplicate the British Empire Building planned for the southwest corner of Fifth Avenue and Fiftieth Street.

A GRANT of $1,232,652 from the Rockefeller Foundation to McGill University for the establishment of a neurological institution was recently announced. The cooperation of both provincial and civic authorities in this work has been assured; more than $150,000 has been pledged by friends of the university and members of the governing board, and plans are well under way to develop at the university a neurological center that will be second to none on this continent. The establishment of the institute will involve the construction of a new building, specially equipped for research in neurology, neurosurgery and the physiology and pathology of the nervous system. Dr. Wilder G. Penfield, clinical professor of neurological surgery at the university, has been appointed director. He will be assisted by a staff headed by Dr. Colin Russell, Dr. F. H. MacKay and Dr. W. V. Cone.

THE twenty-first annual report of the Brooklyn Botanic Garden, 1931, calls attention to the fact that during the past year the attendance at the Botanic Garden was nearly 96,000 more than the year before, and the permanent endowment funds increased by $12,420. The total attendance for the year was more than 1,100,000, equal to nearly half the population of Brooklyn, and the permanent endowment fund is now nearly $1,004,000. The report calls attention to the extensive educational program of the garden, including the extensive cooperation with the public and private schools of greater New York. The school service included the supplying of nearly 5,500 Petri dishes filled with sterilized agar for the classes in biology in the high schools of all five boroughs of greater New York, and the supplying of living plant material for botanical and nature study work to more than 5,700 teachers for the instruction of nearly 224,000 pupils. A special section of the report is devoted to the research work in progress at the garden along the lines of plant pathology, disease resistance in plants, forest pathology, especially in connection with the chestnut blight, an extensive beardless iris project, and work in systematic botany and genetics. Seven students are enrolled at the garden for graduate study and other research.

DISCUSSION

MISNAMED CULTURES AND STUDIES OF THE TUBERCLE BACILLUS

ONE of the recent trends of research with the tubercle bacillus, as reported in the literature, has been the attempts to demonstrate variations in that organism. The effect of these reports apparently has been to create a belief that the original Koch bacillus is only one form of a highly variable micro-organism. This belief has led certain research workers to use in their studies organisms which they designated as tubercle bacilli but which, in all probability, were only acid-fast saprophytes.

The only definite criteria for identifying an organism as a tubercle bacillus are those based upon the personal observations of the workers, since there is no adequate description given in the various classifications. We believe that an organism upon isolation from lesions or any other natural source should conform in general to the following description, in order to be classed as a human or bovine tubercle bacillus.

(1) It grows between 30 and 40° C., the optimum temperature being 37° C.

(2) It is a slow grower, requiring about 4 days to 1 week for visible growth to occur, and 2 to 4 weeks to reach its full development.

(3) It does not grow on plain agar.

(4) It grows only on the surface of liquid media, and the inoculum must be floated on the surface. There is no clouding of the medium at any time.

(5) When grown on liquid media, it produces the essential substances of tuberculin, *i.e.*, it will produce the tuberculin reaction when injected into tuberculous animals.

(6) To quote Calmette, "One should regard as tubercle bacilli only those which, when introduced into the body of a susceptible animal, such as the guinea pig, produce tuberculous lesions inoculable in series."

The identity of a stock culture which is labeled a human or bovine tubercle bacillus in any laboratory or collection, and which has properties markedly different from the above, should be questioned, unless it can be proved a descendant of a true tubercle bacillus.

We have noted that in three recent papers in the journals by Isaacs[1], Eberson and Sweeney[2] and Reed and Rice,[3] and in one published in 1913 by Wherry,[4] the descriptions given of an organism used as a human tubercle bacillus would lead one to suspect that the organism was only an acid-fast saprophyte. The culture employed was the same in each instance. Likewise, in the first study of the series by Reed and Rice,[5] it seems probable that a second saprophyte was used under the impression that it was a bovine tubercle bacillus. Subsequently, we obtained transfers of the two organisms, studied their cultural characteristics and investigated their histories.

The human saprophytic tubercle bacillus was listed as culture 607 in the American Type Culture Collection. The description was as follows:

R. D. Herrold, John McCormick Institute for Infectious Diseases, Chicago. Original strain of Koch, brought over by Novy in 1888. Has lost virulence and grows profusely and quickly on artificial media.

Inasmuch as the culture came from Dr. Novy, we addressed a letter to him, and quote the reply in part as follows.

I have your recent letter of inquiry regarding the tubercle bacillus which you mention as having the history of being brought from Koch's laboratory in 1888. Many years ago Dr. Vaughan was engaged in the study of bacterial proteins and this culture was used by him in the belief that it was a direct descendant of that which was brought from Berlin. I have always been very much in doubt about the matter and I have suspected that a mistake had entered into the history. About five years ago I again mentioned the matter to Dr. Vaughan and told him that I suspected that he had received a lot of saprophytic tubercle bacilli from someone and that a mixup must have taken place. I can not give you any exact history of the culture because the material was entirely in the hands of men in Dr. Vaughan's laboratory and only much later on was the culture taken over by my department, but I have always called it a saprophyte rather than by the name which refers to Koch's original culture.

The properties of the culture as brought out by our study are as follows:

Microscopically. Acid fast when destained with 3 per cent. HCl in 90 per cent. ethyl alcohol. Morphology similar to that of the tubercle bacillus.

CULTURAL CHARACTERISTICS

Dorset's egg medium. Abundant growth in 48 hours at 30 or 37° C., good growth after 48 hours at 20° C. Finely wrinkled, spreading growth becoming bright orange after several days.

Plain agar. Good growth in 48 hours.

Glycerine, phosphate, beef infusion broth. Inoculum very hard to sink. Heavy, very coarsely wrinkled, tan-colored membrane over the whole surface after 4 days at 37° C.

Dorset's asparagin, mineral salts medium. Develops more quickly when 1 per cent. mannite is present than when 3 or 7 per cent. glycerine is present. Clouding of the medium occurs after about two weeks.

It was reported in one of the papers[4] that culture 607 did not produce an allergic condition, *i.e.*, that a second inoculation with bacilli known to be virulent did not evoke the usual local reaction in animals inoculated with the saprophytic strain. In another paper[3] it was stated that the culture did not produce tuberculosis in guinea-pigs.

The bovine saprophytic tubercle bacillus was described as culture 599 in the American Type Culture Collection catalog as follows:

N. J. Lynch, Shelton, Conn. 69a. Original culture American Museum Natural History. 69a came to the museum from the University of Buffalo where it was isolated from tubercles in lungs of cow. 1921. It is non-pathogenic and grows profusely and rapidly.

In a letter dated March 27, 1931, Dr. Lynch, Shelton State Tuberculosis Sanatorium, Shelton, Connecticut, gave us the following information. This culture was sent to him from the American Museum of Natural History as a bovine culture (69a). It grew rapidly but always retained its acid resistance and was non-virulent when inoculated into guinea-pigs and rabbits.

According to our study, the characteristics of this

[1] M. L. Isaacs, "Factors which Influence Tests of Bacterial Survival. I. The Effect of Varying Periods of Incubation of the Survival Test Culture," *J. Bact.*, 20, 161, 1930.

[2] F. Eberson and M. A. Sweeney, "Tinctorial Transmutations of Acid-fast Micro-organisms and Virulence of Tubercle Bacilli," *J. Infectious Diseases*, 49, 301, 1931.

[3] G. B. Reed and C. E. Rice, "Studies in the Variability of Tubercle Bacilli. II. Correlation of Colony Structure, Acid Agglutination, and Virulence," *Can. J. Research*, 5, 111, 1931.

[4] W. B. Wherry, "Some Chemical Changes Favoring the Production of Spores in *Bacillus tuberculosis*," *Zentr. Bakt.*, etc., Orig. 70, 115, 1913.

[5] G. B. Reed and C. E. Rice, "Studies in the Variability of Tubercle Bacilli. I. A Rapid-growing Bovine Type," *Canadian J. of Research*, 4, 388, 1931.

organism are like those of culture 607, except that it develops more slowly at 20° C., requiring one week to attain a good growth at this temperature.

In view of both the cultural characteristics and the history of these cultures, it would seem that there is little or no basis for considering them tubercle bacilli. It is most unfortunate that the results of these three research projects were published as contributions to our knowledge of the characteristics of the tubercle bacilli.

The misleading information thus placed in the literature becomes part of the history of the tubercle bacillus, and through references thereto by the authors of subsequent papers is perpetuated. As an example, we found in a paper by Sweany[6] a reference to Wherry's paper[4] as follows "By growing '801'[7] (the original Koch strain) on synthetic media with various alcohols, Wherry, in 1913, produced spore-like bodies in the bacillus and altered the acid fast staining qualities very markedly."

The blame for these misnamed cultures can not be placed on the curators of type culture collections. Such collections can be only depositories, and it must be the responsibility of each worker to check for himself the identity of the cultures which he uses. We wish to emphasize this point in order that further work with the tubercle bacillus may mean progress rather than confusion in the field.

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READING KNOWLEDGE

THE inadequate language equipment of the average American student and research worker in science is fairly well known. Its consequences, however, are hardly well enough realized. It might serve a purpose to focus attention on this important point by giving a few illustrations. They have not been collected by any systematic search. On the contrary, they all happened to come to the writer's attention on one single day, when he had occasion for looking through the chief American contributions in a very limited field. In all, half a dozen papers by American authors were consulted. In this limited material, two instances were found where an inadequate knowledge of German had led the authors in question to fundamentally wrong interpretations on important points.

One author writing in *Soil Science* says:

> Winogradsky found the nitrate-forming organism in his cultures in two stages, one of which he terms "schwärmer" and the other the "free cell stage." It is doubtful if such forms were present in this work, though such might have been the case. The free-cell type was common in all the cultures, and many strains showed great masses of the organisms which resembled very closely the "schwärmer" stage; however, this latter character of growth differed but slightly from the forms found as free cells . . . although the organisms within the group were occasionally slightly smaller.

The passage quoted is about the only one in the paper from which it could be gathered with some definiteness how the American organism studied compares with the classical Nitrosomonas of Winogradsky. As the statement stands, however, it is devoid of any sense. Apparently because of an insufficient knowledge of German, the author must have taken "Schwärmer" to mean the so-called zooglea form, instead of the free, motile monad form which the German term actually signifies. But the zooglea and the monads represent the two opposite extremes within the series of forms characteristic of these organisms.

In a recent contribution in *Centralblatt für Bakteriologie,* dealing with the same organisms, an American author discusses the findings of a German colleague as follows:

> In this way he secured a culture which was either a new form having power of multiplication in 0.3 per cent. peptone solution or his culture was impure.

Then comes a reference to a footnote, reading:

> Heubült says: "Ohne Zusatz organischer Substanzen findet eine normale Entwicklung statt, auch konnte ich bei einer Zugabe von 0.5% [in the original 0.05%; L.G.R.] Glukose kaum eine Wachstumshemmung feststellen. Dagegen war z. B. bei einem Zusatz von 0.3% Pepton oder 2.0% Natr. butyric. überhaupt kein N_2O_3 nachzuweisen, noch fand Wachstum statt, wie die mikroskopische Kontrolle zeigte."

The American author has evidently translated "noch" by "still" or "yet," instead of by "nor," as would have been correct. Because of this error, he quotes the German author as having found exactly the opposite of what he actually did, and his comment is worded accordingly.

It is to be hoped that the present findings do not represent average conditions. But it seems to be too much in any branch of science to find errors such as those quoted in one third of the papers consulted, and this in papers justly claiming international attention, published in technical journals of high standing. This can not contribute to the international respect for American science. As long as the certified reading knowledge of American graduate students and Ph.D.'s remains as uneven as it is, it would seem to be a minimum requirement on the

[6] H. C. Sweany, "The Granules of the Tubercle Bacillus," *Am. Rev. Tuberc.*, 17, 53, 1928.

[7] Wherry's culture "801" has been identified as American Type Culture Collection Culture 607.

responsible institutions that some control be exercized before its results are exhibited in international journals, and preferably before they are at all presented in print.

Although not directly belonging to the subject, it is hard to refrain from quoting a last oddity found in the bunch of papers referred to above. Harmless as it is, it is instructive by illustrating once more the surprising linguistic illiteracy which can be found in scientific papers. In a publication from Georgia, one finds a printed slip of paper with corrections, one of which reads: "p. 11: 'Vitality' should be 'virility.'" Looking up the page, it appears that no other organisms are mentioned than bacteria, which can not well be virile according to common ideas on the subject. Possibly "virility" was the author's version of "virulence," in his younger days.

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RECENT FIND OF MAMMOTH REMAINS IN THE QUATERNARY OF FLORIDA, TOGETHER WITH ARROW-HEAD

IN September, 1931, Miss Thelma Van Buskirk, a student in Rollins College, brought to the museum a tusk and a tooth found by her brother, Mr. Allen Van Buskirk, a U. S. Government official, during his inspection of canal dredging near Flagler Beach, Florida. These fossils were determined as mastodon remains on basis of illustrations and descriptions in literature, especially Osborn's (1923) "Mastodons and Mammoths of North America." Photographs were made and sent to the Smithsonian Institution, which kindly confirmed the zoological determination.[1]

At my request, Mr. Van Buskirk kindly accompanied me to the spot where he had obtained the objects, and stated that a friend had recently struck some bones near-by while plowing.

Arrangements were immediately made with the owner of the property, Mr. Ed. Johnson, for Rollins College to continue excavations in search of further possible fossils.

About three hundred feet from the point in the canal where the mastodon remains were found, and about ten paces from the point where the plow struck bones, a party of eight[2] started to excavate. Various fossils, as will be described later, were found before much more than a cubic yard of material was removed. Suddenly a large, hard object was located about two and one half feet below the soil surface. In attempting to free this structure, which was entirely under water in the hole that was made, it became necessary to work around and under it with the bare hands; in this manual exploration, a cavity was felt in the surface directed at the time away from the soil surface (*i.e.*, downward). This cavity proved to be large enough to permit the insertion of my hand, thus making possible the careful withdrawal of its wet, loose content. This content contained an arrow-head; the material of which it was made was later determined by Professor J. E. Spurr as chert.

The large object in question, upon being removed, proved to be a pair of lower jaws, each jaw bearing a large tooth. This structure was determined (on basis of comparison with similar local museum material and with literature) as being remains of a mammoth.[1]

The geological formation immediately underlying the horizon in which the fossils occur was determined by J. E. Spurr as a shell marl of late quaternary age; the fossils themselves occur in sandy layers mixed with much organic (vegetable) material.

In addition to the foregoing, one complete needle-like object, and three broken pieces of similar nature, were found from one to seven feet away from, and in the same layer with, the mammoth jaw. These will be described more in detail later.

Excavations are being continued by the students, as time permits, in the hope of obtaining additional data which may possibly prove of value in connection with the question as to the antiquity of man on this continent.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD FOR THE DISARTICULATION OF SKULL BONES

HAVING need of a disarticulated cat skull, the method of filling the skull with dried peas and soaking was resorted to, but repeated trials gave unsatisfactory results. Perhaps due to unequally distributed pressure, the parietals and occipitals were pushed off as a group and the pressure was thus released before complete disarticulation could occur.

It was conceived that some method which would

[1] Later, this determination was concurred in independently by W. W. Holmes, C. W. Stiles, Gene Stirling, and J. H. Chase.

[2] A professor, Dr. Frank Guy Armitage, six students, Harold Cochenour, Guilford Galbraith, Daniel Havens, Robert Maclay, Douglas Riggs, and Jack Connery, and one visitor, Kenneth Wooldridge.

give considerable pressure in all directions in equal degrees would probably correct the faults observed when the dry seed method was used. It was subsequently decided that if the cranium could be filled with water and then subjected to freezing temperature, such a result might be realized, but the question then arose as to just how the water might be retained in the cranial cavity.

It was decided that probably the best manner to fill the skull cavity with water was to first place the water in physical combination with some such substance as gelatine. This was done. Cat skulls were soaked over night in water, then placed in warm dilute gelatine cooled to the solidifying point, then placed in a refrigerator at 0° F, excess gelatine having first been removed from the outside of skull, and the next day the skull was removed from the refrigerator and the ice melted by addition of warm water. The skulls treated in this manner disarticulated very satisfactorily. Skulls soaked in water only and frozen gave negative results. Further experimentation has shown that dilute agar is superior to gelatine.

The method as it is now used is as follows: (1) Soak skulls in water for twelve to twenty-four hours (dry skulls give fair results). (2) Place skulls in warm agar (above 45° C) made by boiling 7.5 gms of agar shred in one liter of water till the shreds have all dissolved. (3) Being sure that the liquid agar has completely filled the cranial and nasal cavities, cool to room temperature, remove the skulls from the solidified mass and freeze. (4) Wash frozen skulls with warm water and with slight leverage with the fingers remove such bones as may not have already fallen loose. (5) Remove any adherent agar with a stream of warm water and bleach bones if desired.

The method has been tried with cat, dog and turtle skulls, and has proven very successful with the first two, but the turtle skull is strongly articulated and further it offers almost no surface upon which pressure can be exerted. The method should prove successful with skulls of many animals, including the human.

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DISCARDED ROENTGEN RAY FILM FOR THE MOUNTING OF MUSEUM SPECIMENS

WE have found that discarded Roentgen ray films serve admirably as material on which to mount certain museum specimens. Film lends itself well to the mounting of small specimens of light weight such as gall bladder, bowel, aorta, and organs of small laboratory animals.

It is our practice to immerse the film in hot water until the emulsion softens, then this is scraped off. The film is allowed to dry and then cut to the desired size. It is well to make an exact fit for the inside of the usual museum jar. The fixed specimen to be mounted is then sewed to the film by means of needle and thread passed through holes that have been punched in the film in appropriate places. The specimen is then placed in the jar, fixing fluid added and the vessel sealed.

The method has obvious advantages: (1) Specimens are suspended in the jar on an invisible material; (2) since the film is transparent, both sides of the specimen are visible; (3) the film is a waste product and usually available and unbreakable; (4) the more cumberson glass frame suspension method with possibility of a broken frame can be dispensed with.

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A NOTE ON THE DETERMINATION OF IRON IN BLOOD AND BIOLOGICAL FLUIDS[1]

IN the determination of iron in blood, milk,[2] etc., as the ferric sulphocyanate, a mixture of amyl alcohol and ether is used to extract the color produced, after the addition of the sulphocyanate. Workers using this procedure are aware of the disagreeable odor, and irritating effect of amyl alcohol upon the mucus membranes of the nose and throat. In an attempt to overcome these objectionable features other substances were tried as a substitute for amyl alcohol, and ethylene glycol monbutyl ether[3] was chosen as the most suitable one.

For the extraction of ferric sulphocyanate the ethylene glycol monobutyl ether is mixed with an equal volume of ethyl ether. The extracted color is more intense than that extracted by amyl alcohol, and it does not seem to fade after standing 24 hours. The new medium proposed has no irritating effect upon the mucus membranes, and no disagreeable odor.

ADOLPH BERNHARD
I. J. DREKTER

[1] From the Achelis Laboratory and A. Jacobi Division for Children, Lenox Hill Hospital, New York.

[2] J. H. Yoe, "Photometric Chemical Analysis," Vol. I, 1928, John Wiley and Sons, N. Y., p. 218-ch. 20; R. P. Kennedy, *J. Biol. Chem.*, 74: 385, 1927; C. A. Elvehjem, *J. Biol. Chem.*, 86: 463, 1930; R. Stugart, *Ind. Eng. Chem.*, Anal. Ed., 3: 390, 1931.

[3] Ethylene glycol monobutyl ether CH_2OH was obtained
$CH_2OC_4H_9$
from the Carbide and Carbon Chemicals Corporation, New York City.

SPECIAL ARTICLES

THE INACTIVATION OF MOSAIC DISEASE VIRUS BY PULVERIZING INFECTED TISSUE

DUGGAR and Armstrong,[1] employing a motor-driven pestle in an agate mortar, found that the virus of tobacco mosaic disease is resistant to 9 hours' grinding. Using a different method, we have also been impressed with the difficulty of inactivating the virus. Complete resistance to grinding would indicate a property not usually associated with animate material; hence the importance of studying this question. We have now found that prolonged comminution of infected plant tissue results in loss of its infectivity. The possibility that the inactivation may be due to oxidation or adsorption has been investigated.

METHODS

The top leaves of several hundred tomato plants with mosaic disease were dried, and powdered by grinding for five minutes with mortar and pestle. This procedure caused no appreciable loss in virus potency.

Varying but measured amounts of the powder were placed with four polished steel balls, 1.1 cm in diameter, in Pyrex bottles[2] specially made to withstand breakage. The vessel was actively agitated in a shaking machine. Virus powder could escape comminution only by clinging to the sides of the bottle above the moving balls. Hence samples were taken only from the bottom of the container. For anaerobic pulverization, a sealed rubber stopper was used, through which passed a glass tube for attachment to the Boëz apparatus.[3] The indicator of relative anaerobiosis was 0.01 per cent. methylene blue in dextrose broth. 0.1 cc was placed in an unsealed ampoule with a double constriction of its neck to prevent leakage. It was protected by a wire cage which was attached to the lower surface of the stopper. A separate anaerobic container was used for each test material. Ten experiments were made and samples pulverized for periods up to twelve hours, were injected into 335 tomato plants.

In three adsorption tests virus powder was mixed with normal plant powder which had been pulverized 4 and 10½ hours, respectively. This mixture was either shaken for 3 hours and its aqueous suspension immediately filtered, or it was allowed to stand as a suspension for 2 hours before filtration. In addition, the relative amount of virus filtrable from suspensions of large and small particles was studied.

Virus particles of three sizes were obtained by winnowing, as follows:—A glass tube, 1.5 m long and 2.8 cm inside diameter, was fixed vertically. To the bottom was attached a glass vessel containing virus powder through which a stream of air was forced, blowing the material into the vertical tubing. The top of the apparatus was fitted with an air escape and a trap for the collection of the finest particles. After removing the latter, the remaining powder was divided into coarse and medium sized particles by increasing the air current. In the three tests just described 190 plants were inoculated to determine virus potency.

All filtrations were made through Berkefeld "N" candles. Plants were inoculated by the method described by McKinney,[4] usually with a series of tenfold dilutions beginning with 1 per cent.

RESULTS AND DISCUSSION

With the method of pulverizing employed, partial or complete inactivation of the virus in the dilutions used occurred in 12 hours. The degree of inactivation varied with the time and intensity of pulverization. The following table shows the results of the inoculation of 18 plants with material obtained in two typical experiments.

		5 min.	1 hr.	2 hrs.	3 hrs.	4 hrs.	6 hrs.	12 hrs.
Test 1	No of positives of 18 plants	15	10	5	No test	0	0	0
Test 2		11	No test	No test	14	No test	8	2

While the procedure of pulverization did not raise the temperature of the container to a perceptible degree, nevertheless the development of local heat should be considered, for the heat may destroy the virus or act as an oxidizing agent. In this connection it is of interest that the plant tissue turns from green almost to white after 12 hours' aerobic comminution but from green to still darker green after similar anaerobic procedure. An attempt was made to minimize any local heat by packing the container in carbon dioxide snow. But in this instance no change in the degree of inactivation was observed.

It was thought that if inactivation took place under aerobic and not under anaerobic conditions, it might be ascribed to oxidation. But the inactivation of the virus took place more quickly under anaerobic conditions. For example, in two typical tests, 30 of 32 plants inoculated with material before comminution

[1] B. M. Duggar and J. K. Armstrong, *Ann. Missouri Botanical Garden*, 10, 191, 1923.

[2] Similar in size and shape to centrifuge bottle No. 3139-A of the Arthur H. Thomas catalogue, and made by the Corning Glass Works, Corning, New York.

[3] L. J. Boëz, *J. Bact.*, 13, 227, 1927.

[4] H. H. McKinney, *J. Agric. Res.*, 35, 13, 1927.

were positive and 20 of 32 plants injected with virus pulverized for 12 hours under aerobic conditions showed mosaic disease, whereas none of 29 plants inoculated with material pulverized anaerobically for 12 hours was affected. Perhaps under lowered oxygen tension the virus is reduced at the expense of tissue oxidation. However this may be, virus previously comminuted anaerobically was not reactivated when pulverized later aerobically.

The possibility of the loss of infectivity being due to adsorption of virus by powdered tissue must be considered. In the three adsorption experiments above described, 75 per cent. of 104 plants were positive after the inoculation of comminuted virus mixed with finely pulverized normal plant tissue, as compared with 77 per cent. of 86 control plants injected with virus powder alone. It should be pointed out, however, that under the conditions of the experiments forceful impact of particles as in the ordinary procedure did not occur. In the winnowing experiment, in which particles of three degrees of magnitude were obtained, no differences in virus potency were found. It follows that there was no greater tendency of the smaller particles to adsorb virus. Adsorption, if it occurs, is therefore probably not the main cause of the inactivation.

Conclusion

Tomato mosaic virus loses its infectivity when tissues containing it are comminuted by the method described.

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STUDIES ON THE ETIOLOGY OF POLIOMYELITIS: ISOLATION AND CULTIVATION OF AN ORGANISM AND TRANSMISSION OF THE DISEASE IN MONKEYS

Poliomyelitis (infantile paralysis) has been experimentally reproduced in monkeys with the third, fourth, sixth, eighth, ninth, eleventh and thirteenth "generations" of an organism isolated and grown artificially from the nervous tissues of monkeys known to be infected with the virus responsible for the disease. The organism was cultivated from Berkefeld filtrates prepared from such poliomyelitic materials. It is extremely small, measuring approximately 1/500,000 to 1/250,000 of an inch, and has been grown in a special food medium containing minced sheep brain. In the thirteenth subplant the dilution of the original inoculum cultivated was approximately 2×10^{-27}.

Certain requirements must be met in order to show that a microbe may have something to do with a disease. These are known as the Koch postulates, and demand first, the isolation of the organism in pure culture from the animal harboring the disease; second, the reproduction of the identical disease by the inoculation of these germs into healthy susceptible animals; third, the recovery from such experimentally infected animals of the identical original microbe; fourth, the reproduction once again of the typical disease with these "recaptured" germs.

All these conditions have been fulfilled by the organism that has been reported and described. The disease, furthermore, has been carried on through a series of monkeys in which the infection was produced by means of Berkefeld filtrates or suspensions of nervous tissues prepared from the animals originally inoculated with the microbe. From such "passage" monkeys it was also possible to recover the same germ.

The experiments proved that the "recaptured" virus had the same properties of the original substance known to cause poliomyelitis. These characteristics are its ability to pass through fine filters, to induce typical infection with the characteristic clinical and pathological changes, and lastly, to appear again in a pure culture identical with the original organism.

The most recent studies in our laboratory have shown that the blood serum from a series of monkeys infected with the organism and now convalescent from poliomyelitis, possessed the power to neutralize and combat the ordinary filterable virus of infantile paralysis. This has been demonstrated as follows: Mixtures of a minute amount of each serum with a large amount of active virus were inoculated into the brain of a series of healthy monkeys. These animals did not develop the disease whereas those that received the virus alone succumbed to poliomyelitic infection. To verify the fact further, the animals that furnished these protective serums were likewise inoculated into the brain with active virus alone. These animals resisted the inoculation whereas another set of monkeys that had never had the disease became paralyzed in the typical manner. Thus the convalescent monkeys proved to be immune to the infection and showed immune substances in the blood serum capable of neutralizing the virus of the disease. The resistance to poliomyelitis, therefore, was the same as that which results when the animal recovers from an infection caused by the ordinary poliomyelitis virus filtrate. These observations suggest that the microorganism behaved exactly like the virus.

It must be understood that there are certain established methods for the experimental proof of the

microbial cause of any disease. These methods have been followed and have fulfilled desired requirements designed to show the relationship of a microbe to the disease in question. That hidden factors may still exist is admitted frankly, only because our present methods of attack upon a problem of this type may be inadequate for bringing to light such concealed factors. However, only those facts which have come out of this research have been utilized in drawing justifiable conclusions warranted by the facts, and these must be based upon the only available methods of approach that are known at the present time.

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THE RELATIONSHIP BETWEEN THE WATER CONTENT AND OXYGEN CONSUMPTION OF THE ORGANISM

THE rôle of water as a medium of reaction within the cell has not yet been fully comprehended. This is not surprising in view of the fact that the conditions that control the distribution of water from free to bound states have been elusive. At the suggestion of Dr. J. W. Buchanan, the experiments[1] summarized here were undertaken as an attempt to disclose a possible relation between free water, *i.e.*, water that may be added or abstracted by changed osmotic conditions, and the rate of oxidative reactions in the organism. Such a relation would rest fundamentally on the law of mass action, that is, the relative concentrations of oxidizable substrates and oxidative enzymes.

Previous observations are apparently conflicting. Certain investigators[2] have measured increases in respiratory metabolism in dehydrated tissues, while, conversely, others[3] have showed water uptake to be associated with decreased metabolism. On the other hand, there is some evidence that the opposite relationship may hold true.[4]

The writer used *Planaria dorotocephala* and early embryos of *Amblystoma punctatum*. Water content was controlled by immersing the animals in solutions of differing osmotic pressures, and oxygen consumption was measured in two ways, with the Winkler method and by a microrespirometer.

As far as possible the same individuals were tested under different conditions over three-hour periods. Each period in a test solution was preceded by one in tap water to establish a norm and a control for successive measurements.

The averaged results of the Winkler tests are grouped into the following table.

PER CENT. CHANGES IN RATE OF OXYGEN CONSUMPTION

	Planaria dorotocephala	*Amblystoma punctatum*
Distilled water	−54	−21
Ringer's solution	+43	+62

These observations were checked by numerous experiments with the respirometer. It was found excellent for use with amphibian embryos but unsatisfactory for Planaria due to necessary shaking which prevented the animals from coming to rest. In the case of the former dehydration yielded an average increase of 39 per cent. above the normal in tap water, while treatment with distilled water lowered the rate of oxygen consumption about 42 per cent.

Early *Amblystoma* embryos, when immersed in distilled water, half tap- half distilled water, half Ringer's, and full Ringer's, reached and maintained their maximum swelling or shrinkage within sixty minutes, while planarians show water content changes over a period of one half to six hours in Ringer's and one half to more than sixteen hours in distilled water.[5] Sections of animals so treated indicate that water changes are both inter- and intracellular. At present no rules generally applicable to all animals can be drawn.

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[1] The work was carried out at the Osborn Zoological Laboratory, Yale University.

[2] E. Kreps, Pfluger's Arch., 222, 215–233, 1929; G. T. Caldwell, *Physiol. Zool.*, IV, 2, 324–359, 1931; J. W. Buchanan, *Jour. Exp. Zool.*, 57, 3, 455–472, 1930.

[3] J. W. Buchanan, *Jour. Exp. Zool.*, 57, 2, 307–330, 1930; *Biol. Bul.* LX, 3, 309–326, 1931.

[4] L. C. Beadle, *Jour. Exp. Biol.*, VIII, 3, 211–227, 1931.

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[5] L. C. Beadle, *Jour. Exp. Biol.*, VIII, 3, 211–227, 1931.